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(54) TREATING AGENT FOR HALOGENATING GAS, ITS MANUFACTURE AND METHOD FOR MAKING HARMLESS USING THE SAME

(57)Abstract:

PROBLEM TO BE SOLVED: To efficiently decompose a compound containing a halogen by using calcium oxide or magnesium oxide which is prepared by containing at least one kind of a compound to be selected from an alkali metal chloride, alkali metal fluoride or the like and burning it in a nitrogen atmosphere.

SOLUTION: When a treating agent for making harmless is manufactured by decomposing efficiently an organic halogen compound or the like at a high decomposing rate, calcium carbonate or calcium hydroxide or the like is used as a raw material. Then, one kind of a compound to be selected from sodium chloride, potassium chloride, potassium fluoride, lithium fluoride or the like is added within a range of 0.01 to 10 wt.% to the raw material, and burnt in a nitrogen atmosphere to manufacture the product. In using, at least one kind of such halogenating gas treating agents is filled in an excluding apparatus, and brought in contact with a halogenating gas at 200 to 900° C. Thereby, operation can be executed for a long period of time, and can be continuously treated regardless of a concentration of the halogen compound in the gas.

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## CLAIMS

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### [Claim(s)]

[Claim 1]A halogenated gas processing agent which contains at least one sort of compounds chosen from a group which consists of an alkali-metal-salt ghost, an alkaline earth metal chloride, and alkali metal fluoride, and consists of a calcium oxide or magnesium oxide prepared by calcinating under a nitrogen atmosphere.

[Claim 2]Halogenated gas processed by the processing agent according to claim 1, The processing agent according to claim 1 which is a thing containing at least one sort in  $\text{CF}_4$ ,  $\text{C}_2\text{F}_6$ ,  $\text{C}_3\text{F}_8$ ,  $\text{CHF}_3$ ,  $\text{CCl}_2\text{F}_2$ ,  $\text{CHClF}_2$ ,  $\text{SF}_6$ , and  $\text{NF}_3$ .

[Claim 3]Calcium carbonate or calcium hydroxide, Or magnesium carbonate or magnesium hydroxide is used as a raw material, In this raw material, sodium chloride, potassium chloride, a calcium chloride, a magnesium chloride, A manufacturing method of the processing agent according to claim 1 adding in 0.01 to 10% of the weight of the range, and calcinating at least one sort of compounds chosen from a group which consists of sodium fluoride, potassium fluoride, and lithium fluoride under a nitrogen atmosphere.

[Claim 4]A detoxication method of halogenated gas filling up an eliminating unit with at least one sort of the processing agent according to claim 1, and contacting it to halogenated gas at 200~900 \*\*.

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

#### [0001]

[Field of the Invention]This invention A perfluoro compound (PFCs), a hydro-fluoro compound (HFCs), Organic halogenated compounds, such as chlorofluorocarbon (CFCs) and hydrochlorofluorocarbon (HCFCs). It is related with a processing agent for disassembling and detoxicating inorganic-halogens compounds (halogenated compound containing especially fluoride and chlorine), such as  $\text{SF}_6$  and  $\text{NF}_3$ , etc. by efficient high cracking severity, a manufacturing method for the same, and the detoxication method of the halogenated gas using this processing agent.

#### [0002]

[Description of the Prior Art]The compound containing halogen, such as fluoride, exists in the gas discharged from the etching process and CVD process of a chip fabrication factory. Specifically, compounds, such as PFCs(es), such as  $\text{CF}_4$ ,  $\text{C}_2\text{F}_6$ ,  $\text{C}_3\text{F}_8$ ,  $\text{SF}_6$ ,  $\text{NF}_3$ , and  $\text{CHF}_3$ , and HFCs, are contained. Chlorofluorocarbon, such as  $\text{CCl}_2\text{F}_2$  and  $\text{CHClF}_2$ , is used for refrigerants, such as a refrigerator and a car air conditioner. When discarding a refrigerator and a car, the processing poses a problem. Although damage was once emitted to the atmosphere and has affected global warming from few things to a

human body except for that the amount used is slight and NF, as compared with a detergent or a refrigerant, PFCs, HFCs, etc. in the exhaust gas from an etching process or a CVD process. Various measures are taken at the present. On the other hand, it is well known that various measures are taken so that they may protect an ozone layer, since CFCs, HCFCs, etc. have the large ozone destruction coefficient.

[0003]Also in the above-mentioned measure, it is the processing agents or these solution of the solid state which used the alkali metal compound and the alkaline earth metal compound, and is the method by which a reaction (adsorption, absorption) and carrying out a pyrolysis were well known in halogenated gas. However, when carrying out the pyrolysis of the halogenated gas by such a processing agent, there are problems, such as making indispensable the elevated temperature of 900-1200 \*\*. Especially CF<sub>4</sub> is dramatically stable and a pyrolysis is difficult for it. The problem of harmful acid gas and oxidizing gas being emitted is also produced by the pyrolysis. Thus, the method which detoxicates halogenated gas thoroughly, and the method of processing does not still have, and can be processed with regards to the concentration of the halogenated compound in gas that there is nothing is not found, either, but the art which can solve the above problems is expected.

[0004]Therefore, moreover, the purpose of this invention can disassemble efficiently comparatively the compound containing halogen, such as PFCs, HFCs, HCFCs, and CFCs, at low temperature. And by also being able to detoxicate the toxic substance which is the decomposition product, and combining with an eliminating unit, it can operate over a long period of time, and is in providing the halogenated gas processing agent which can be processed continuously [there is nothing and] with regards to the concentration of the halogenated compound in gas.

[0005]

[Means for Solving the Problem]As a result of inquiring wholeheartedly that the above-mentioned purpose should be attained, this invention persons contained a specific compound, and did the knowledge of the ability of a calcium oxide and magnesium oxide which were calcinated and prepared under specific conditions to process halogenated gas by high cracking severity. This invention was made based on the above-mentioned knowledge, and provides a detoxication method of halogenated gas using a manufacturing method of the following halogenated gas processing agent and this processing agent, and this processing agent.

[0006]"A halogenated gas processing agent which contains at least one sort of compounds chosen from a group which consists of an alkali-metal-salt ghost, an alkaline earth metal chloride, and alkali metal fluoride, and consists of a calcium oxide or magnesium oxide prepared by calcinating under a nitrogen atmosphere."

[0007]"Calcium carbonate or calcium hydroxide, Or magnesium carbonate or magnesium hydroxide is used as a raw material, In this raw material, sodium chloride, potassium chloride, a calcium chloride, a magnesium chloride, Manufacturing method of a halogenated gas processing agent of above-mentioned this invention adding in 0.01 to 10% of the weight of the range, and calcinating at least one sort of compounds chosen from a group which consists of sodium fluoride, potassium fluoride, and lithium fluoride under a nitrogen atmosphere."

[0008]"A detoxication method of halogenated gas filling up an eliminating unit with at least one sort of a halogenated gas processing agent of above-mentioned this invention, and contacting it to halogenated gas at 200-900 \*\*."

[0009]

[Embodiment of the Invention] Hereafter, the detoxication method of the halogenated gas using the manufacturing method of the halogenated gas processing agent of this invention and this processing agent and this processing agent is explained in full detail. Although the calcium oxide or magnesium oxide which constitutes the halogenated gas processing agent of this invention contains at least one sort of compounds chosen from the group which consists of an alkali-metal-salt ghost, an alkaline earth metal chloride, and alkali metal fluoride, With this "calcium oxide containing at least one sort of compounds chosen from the group which consists of an alkali-metal-salt ghost, an alkaline earth metal chloride, and alkali metal fluoride or magnesium oxide." When a calcium oxide or magnesium oxide is manufactured using raw materials, such as calcium carbonate or calcium hydroxide, magnesium carbonate or magnesium hydroxide, After adding the above-mentioned chloride or fluoride in the above-mentioned raw material, it is the calcium oxide or magnesium oxide produced by calcinating, and what carried out adding after mixing of the above-mentioned chloride or the fluoride to the calcium oxide or magnesium oxide which calcinated and obtained the above-mentioned raw material does not contain.

[0010] As a desirable embodiment of the halogenated gas processing agent of this invention, the halogenated gas processing agent of the following \*\* - \*\* is mentioned, for example.

\*\* The halogenated gas processing agent which is a calcium oxide containing at least one sort of an alkali-metal-salt ghost or an alkaline earth metal chloride, and was prepared by calcinating under a nitrogen atmosphere.

\*\* The halogenated gas processing agent which is magnesium oxide containing at least one sort of an alkali-metal-salt ghost or an alkaline earth metal chloride, and was prepared by calcinating under a nitrogen atmosphere.

\*\* The halogenated gas processing agent which is a calcium oxide containing at least one sort of alkali metal fluoride, and was prepared by calcinating under a nitrogen atmosphere.

\*\* The halogenated gas processing agent which is magnesium oxide containing at least one sort of alkali metal fluoride, and was prepared by calcinating under a nitrogen atmosphere.

The halogenated gas processing agent of this invention is explained below with the manufacturing method about the desirable embodiment of the above-mentioned \*\* - \*\*.

[0011] First, above-mentioned embodiment \*\* is explained. Although the calcium oxide is marketed and can be obtained easily, these commercial items have small voidage, and since specific surface area is not large, either, they are lacking in reactivity. This is considered to be a place depended on the process on a general industry of a calcium oxide. That is, it is because limestone (the main ingredients are calcium carbonate) is calcinated at the temperature of not less than 1000 \*\* among the air for a long time while it has been massive, so a crystal sinters and it is impossible to acquire a sufficient opening and surface activity. The halogenated gas processing agent of this embodiment \*\* by adding an alkali-metal-salt ghost or an alkaline earth metal chloride in a raw material, and calcinating under a nitrogen atmosphere in front, as mentioned above, at the time of calcination of a raw material, Sintering of the crystal at the time of calcination is controlled, and it makes as [ process / to halogenated gas / by high reactivity / according to high cracking severity / halogenated gas ].

[0012] The addition of the above-mentioned chloride has 0.09 to 5.0% of the weight of a range preferred in

especially an alkali-metal-salt ghost 0.01 to 7.0% of the weight to the amount of theories of the calcium oxide to generate, and 0.09 to 5.0% of the weight of its range is preferred 0.01 to 10% of the weight in especially an alkaline earth metal chloride. If more than this, a reactant high output will be hard to be acquired by PORASU, and the decomposition efficiency of gas will also worsen. An effective output is hard to be acquired also when less than this.

[0013]As the above-mentioned alkali-metal-salt ghost, sodium chloride and potassium chloride are preferred and a calcium chloride and a magnesium chloride are preferred as the above-mentioned alkaline earth metal chloride. Calcium hydroxide besides calcium carbonate etc. is used as a raw material in which the above-mentioned chloride is added.

[0014]Although it is usually preferred to carry out at 900-1100 \*\* for 2 to 5 hours as for the calcination under the above-mentioned nitrogen atmosphere, when using calcium hydroxide as a raw material, it can be calcinated at about 600 \*\*.

[0015]only compared with the calcium oxide which only calcinated calcium carbonate and calcium hydroxide, specific surface area is boiling markedly the halogenated gas processing agent of this embodiment \*\*, and is increasing it. For example, the mixture which added 5 g (0.9 % of the weight / CaO) of sodium chloride to 1 kg of granular calcium carbonate, The halogenated gas processing agent prepared by putting into an electric furnace (the heating rate of 200 \*\* / hr), and calcinating at 900 \*\* under a nitrogen atmosphere, It becomes specific surface area 7-8m<sup>2</sup>/g (BET adsorption method) and 55 to 65% (method of mercury penetration) of voidage, and specific surface area is increasing by 3 to 4 times compared with the calcium oxide prepared without adding a chloride. The specific surface area and voidage in which what added 0.9% of the weight and calcinated the magnesium chloride under the same conditions as the above instead of is almost the about the same are obtained, and it is high reactivity to halogenated gas. [ sodium chloride ] Even if it compares the halogenated gas processing agent of this embodiment \*\* with what carried out adding after mixing of the above-mentioned chloride to the commercial calcium oxide, and prepared it to it, it is high reactivity.

[0016]Next, above-mentioned embodiment \*\* is explained. The halogenated gas processing agent of this embodiment \*\* is prepared at the same process as the halogenated gas processing agent of the above-mentioned embodiment \*\* except having used magnesium carbonate or magnesium hydroxide as a raw material.

[0017]The addition of the above-mentioned chloride in this embodiment \*\* has [ in / to the amount of theories of the magnesium oxide to generate / any of an alkali-metal-salt ghost and an alkaline earth metal chloride ] 0.09 to 5.0% of the weight of an especially preferred range 0.05 to 10% of the weight. What is necessary is just to usually perform calcination under a nitrogen atmosphere at 600-900 \*\* for about 1 to 5 hours.

[0018]Next, above-mentioned embodiment \*\* is explained. The halogenated gas processing agent of this embodiment \*\* is prepared at the same process as the halogenated gas processing agent of the above-mentioned embodiment \*\* except having used alkali metal fluoride instead of the above-mentioned chloride.

[0019]The addition of the above-mentioned alkali metal fluoride in this embodiment \*\* has 0.05 to 5.0% of the weight of an especially preferred range 0.01 to 10% of the weight to the amount of theories of the calcium oxide to generate. As the above-mentioned alkali metal fluoride, sodium fluoride, potassium fluoride,

and lithium fluoride are preferred. What is necessary is just to usually perform calcination under a nitrogen atmosphere at 900-1100 \*\* for about 1 to 5 hours.

[0020]Next, above-mentioned embodiment \*\* is explained. The halogenated gas processing agent of this embodiment \*\* is prepared at the same process as the halogenated gas processing agent of the above-mentioned embodiment \*\* except having used magnesium carbonate or magnesium hydroxide as a raw material.

[0021]The addition of the alkali metal fluoride in this embodiment \*\* has 0.05 to 5.0% of the weight of an especially preferred range 0.01 to 10% of the weight to the amount of theories of the magnesium oxide to generate. What is necessary is just to usually perform calcination under a nitrogen atmosphere or more by 600 for about 1 to 5 hours.

[0022]The halogenated gas processing agent of this invention may be used independently, and two or more sorts may use it, mixing. In contact with halogenated gas, arranging one of the specific processing agents in the preceding paragraph, arranging other other processing agents in the latter part, and making it contact one by one etc. can also perform use by combination. As halogenated gas processed by the halogenated gas processing agent of this invention, The gas containing at least one sort in  $\text{CF}_4$ ,  $\text{C}_2\text{F}_6$ ,  $\text{C}_3\text{F}_8$ ,  $\text{CHF}_3$ ,  $\text{CCl}_2\text{F}_2$ ,  $\text{CHClF}_2$ ,  $\text{SF}_6$ , and  $\text{NF}_3$  is mentioned. 200-900 \*\* is desirable especially preferred, and the temperature to which the halogenated gas processing agent and the above-mentioned halogenated gas of this invention are contacted is 300-800 \*\*. Most stable  $\text{CF}_4$  can also be decomposed nearly thoroughly at 800 \*\*. The reaction of the halogenated gas processing agent of this invention and the above-mentioned halogenated gas progresses promptly above 200 \*\*.

[0023]Next, by combining the halogenated gas processing agent of this invention with an eliminating unit explains the detoxication method of this invention which detoxicates halogenated gas. The meter for having a gas reaction part which can be filled up with one or more sorts of the halogenated gas processing agent of this invention as the above-mentioned eliminating unit, for example, measuring, and controlling the temperature in this reaction part, What installed the infrared absorption method detector for what installed the electric furnace for carrying out heat tracing being mentioned, and detecting an unreacted halogenated compound about the gas after reaction part passage further is preferred. Since the above-mentioned detector detects the unreacted halogenated compound in emission gas by this, the deterioration condition of a processing agent can be known and exchange or supplying time of a processing agent can be monitored from the outside.

[0024]the reaction part putting reactor 2 tower in order in parallel, and it using one tower first and it, when the detector had detected the unreacted halogenated compound in emission gas, the gas introduction valve was intact --- already -- what constructed the control system so that it might change to one tower and gas could be introduced there is preferred. Since the processing agent of a used reactor is exchangeable after a valve changes, continuous running of halogenated gas detoxicating treatment becomes possible.

[0025]When processing with reactor 1 tower, the processing agent feed zone and the processing agent discharge part are equipped, It is good by discharging the used processing agent in a reactor out of a system from a processing agent discharge part automatically, if a detector detects the unreacted halogenated compound in emission gas, and supplying a processing agent from a processing agent feed zone to enable it to process continuously or intermittently.

[0026]A processing agent feed zone is a device for supplying a processing agent into a reactor, and specifically comprises a processing agent constant feeding part, a processing agent carrying out portion, and a processing agent stores dept. If the device for carrying out constant feeding, the automatic valve for carrying out automatic feed of it, etc. are installed, and a processing agent constant feeding part monitors the halogenated compound in emission gas in a detector and reaches predetermined concentration, it will carry out automatic feed of the processing agent. A processing agent carrying out portion is for taking out a processing agent from a stores dept. to a constant feeding part, for example, has methods, such as a screw feeder type, a blow type, and an endless-belt type, and is not limited in particular. A processing agent stores dept. will not be limited [ size / construction material, shape, ], if it is a storage warehouse for supplying a processing agent to a reactor and is a container which can store a processing agent.

[0027]A used processing agent is discharged by the processing agent discharge part out of a system. A processing agent discharge part comprises a discharge part, a carrying out portion, and a chemical waste agent stores dept., and a discharge part is sent out by the carrying out portion which discharged and mentioned the chemical waste agent above from the reactor by methods, such as an oscillating type, a screw feeder type, a rotary or a roll feeder type, a table feeder type, and a belt feeder type, to a chemical waste agent stores dept. If a chemical waste agent storehouse is a container which a chemical waste agent can keep, it will not be limited [ size / construction material, shape, ]. Also in these chemical waste agent discharge, it can discharge automatically by combining with gas detection. These methods are not examples and are not necessarily limited especially. Thus, operation becomes possible over a long period of time, with regards to the concentration of the halogenated compound in distributed gas, there is nothing and halogenated gas can be processed continuously.

[0028]200~900 \*\* of contact with the halogenated gas processing agent of this invention and halogenated gas with which the above eliminating units were filled up is more preferably performed under the temperature of 300~800 \*\*. Thus, by contacting the halogenated gas processing agent and halogenated gas of this invention, The halogenated gas containing  $\text{CF}_4$ ,  $\text{C}_2\text{F}_8$ ,  $\text{C}_3\text{F}_8$ ,  $\text{SF}_6$ ,  $\text{NF}_3$ ,  $\text{CHF}_3$ ,  $\text{CCl}_2\text{F}_2$ , one or more sorts of  $\text{CHClF}_2$ , etc., It can process by not less than 99.9% of cracking severity.

[0029]

[Example]Hereafter, an example explains this invention further.

[0030]To  $\text{CaCO}_3$ 2kg which was ground in the shape of one grain of example, and the comb exception made into the particle diameter of 3~6 mm, what added  $\text{NaCl}$  0.09% of the weight, and was mixed was calcinated at 900 \*\* after temperature up at 200 \*\*/h under  $\text{N}_2$  atmosphere for 5 hours, and the halogenated gas processing agent was prepared to it.

[0031]The halogenated gas processing agent was prepared like Example 1 except having calcinated in 21100 \*\* of the examples.

[0032] $\text{Ca}(\text{OH})_2$  was used instead of example 3 $\text{CaCO}_3$ , and the halogenated gas processing agent was prepared like Example 1 except having calcinated at 600 \*\*.

[0033]The halogenated gas processing agent was prepared like Example 1 except having added  $\text{KCl}$  instead of example 4 $\text{NaCl}$ .

[0034]The halogenated gas processing agent was prepared like Example 1 except having added  $\text{CaCl}_2$  instead of example 5 $\text{NaCl}$ .

[0035]CaCO<sub>3</sub> ground in the shape of one grain of comparative example was calcinated at 600 \*\* in the air, and the halogenated gas processing agent was prepared.

[0036]The halogenated gas processing agent was prepared like the comparative example 1 except having calcinated by 2900 \*\* of comparative examples.

[0037]CaO ground in the shape of three grains of comparative examples was calcinated at 900 \*\* under N<sub>2</sub> atmosphere, and the halogenated gas processing agent was prepared.

[0038]What added NaCl 0.09% of the weight to Ca(OH)<sub>2</sub> ground in the shape of four grains of comparative examples, and was mixed to it was calcinated at 600 \*\* in the air, and the halogenated gas processing agent was prepared.

[0039]What added NaCl 0.09% of the weight to CaCO<sub>3</sub> ground in the shape of five grains of comparative examples, and was mixed to it was calcinated at 900 \*\* in the air, and the halogenated gas processing agent was prepared.

[0040]To MgCO<sub>3</sub>2kg which was ground in the shape of six grains of examples, and the comb exception made into the particle diameter of 3-6 mm, what added CaCl<sub>2</sub> 5.0% of the weight, and was mixed was calcinated at 600 \*\* under N<sub>2</sub> atmosphere for 5 hours, and the halogenated gas processing agent was prepared to it.

[0041]The halogenated gas processing agent was prepared like Example 6 except having used Mg(OH)<sub>2</sub> instead of example 7MgCO<sub>3</sub>.

[0042]MgO ground in the shape of six grains of comparative examples was calcinated at 600 \*\* under N<sub>2</sub> atmosphere, and the halogenated gas processing agent was prepared.

[0043]To CaCO<sub>3</sub>2kg which was ground in the shape of eight grains of examples, and the comb exception made into the particle diameter of 3-6 mm, what added NaF 0.05% of the weight, and was mixed was calcinated at 1000 \*\* after temperature up at 200 \*\*/h under N<sub>2</sub> atmosphere for 5 hours, and the halogenated gas processing agent was prepared to it.

[0044]Ca(OH)<sub>2</sub> was used instead of example 9CaCO<sub>3</sub>, and the halogenated gas processing agent was prepared like Example 8 except having calcinated at 900 \*\*.

[0045]The halogenated gas processing agent was prepared like Example 8 except having added LiF instead of example 10NaF.

[0046]The halogenated gas processing agent was prepared like Example 8 except having added KF instead of example 11NaF.

[0047]It is the following about the raw material in the above-mentioned Examples 1-11, an additive, its addition, and a firing condition (atmosphere and temperature). It is the following about a raw material [ in / again / to [Table 1] / the above-mentioned comparative examples 1-6 ], an additive, its addition, and a firing condition (atmosphere and temperature). It collected into [Table 2], respectively and was shown in it.

[0048]

[Table 1]

実 施 例	原 料	添 加 物			焼成温度 (°C)
			添加量 (wt%)	雰囲気	
1	CaCO <sub>3</sub>	NaCl	0.09	窒素	900
2	CaCO <sub>3</sub>	NaCl	0.09	窒素	1100
3	Ca(OH) <sub>2</sub>	NaCl	0.09	窒素	600
4	CaCO <sub>3</sub>	KCl	0.09	窒素	900
5	CaCO <sub>3</sub>	CaCl <sub>2</sub>	0.09	窒素	900
6	MgCO <sub>3</sub>	CaCl <sub>2</sub>	5.0	窒素	600
7	Mg(OH) <sub>2</sub>	CaCl <sub>2</sub>	5.0	窒素	600
8	CaCO <sub>3</sub>	NaF	0.05	窒素	1000
9	Ca(OH) <sub>2</sub>	NaF	0.05	窒素	900
10	CaCO <sub>3</sub>	LiF	0.05	窒素	1000
11	CaCO <sub>3</sub>	KF	0.05	窒素	1000

[0049]

[Table 2]

比較例	原 料	添 加 物	添加量 (wt%)	雰囲気	焼成温度 (°C)
1	CaCO <sub>3</sub>	なし	-	空 気	600
2	CaCO <sub>3</sub>	なし	-	空 気	900
3	CaO	なし	-	窒 素	900
4	Ca(OH) <sub>2</sub>	NaCl	0.09	空 気	600
5	CaCO <sub>3</sub>	NaCl	0.09	空 気	900
6	MgO	なし	-	窒 素	600

[0050]Next, the example of an examination and the example of a comparative study which processed halogenated gas using the halogenated gas processing agent obtained by above-mentioned Examples 1-11 and the comparative examples 1-6 are shown.

As a <basic operation of example of examination, and example of comparative study> reactor, the pipe made from SUS 42 mm in inside diameter and 1000 mm in length was set vertically, from the pars basilaris ossis occipitalis of the reactor filled up with the various processing agent, the nitrogen gas for dilution was mixed to the upper part, and various halogenated gas was introduced to it. Heat tracing of the reactor was carried out with the electric furnace, and temperature was adjusted so that it might become the internal temperature of 200 \*\* - 800 \*\*. The restoration cylinder of halogenated gas and nitrogen gas was attached, and it decompressed with the pressure regulator, and the flow of mixed gas was made into 500 ml/min, and was introduced into the entrance side of the reactor for 10 minutes. In order to analyze emission gas in the exit of a reactor, the chief editor line was branched and the sampling port was installed. Gas chromatography analyzed the emission gas extracted from the sampling port. The flow of introductory gas or emission gas was measured with the dry gas meter. After the filling method of the processing agent to a reactor filled a SUS mesh and a wire gauze in the pars basilaris ossis occipitalis of a reactor, it was filled up with the processing agent 700g with a particle diameter of 3.5-5.5 mm. The decomposition efficiency (%) of halogenated gas was searched for by the following formula.

[1 - (quantity of the undecomposed halogenated compound in emission gas / introduced quantity of a halogenated compound)] × 100 [0051]The example 1 of an examination - 12 following With the halogenated gas processing agent, the halogenated gas kind, the halogenated gas introduction amount, the nitrogen introduction amount, and reaction temperature which are shown in [Table 3], the above-mentioned basic operation was carried out, respectively, gas chromatography analyzed the emission gas extracted from the

sampling port, and the cracking severity of halogenated gas was searched for. It is the following about the result. It was shown in [Table 3]. Following To the exhaust gas processed by the halogenated gas processing agent of this invention, so that clearly from the result shown in [Table 3]. The halogenated compound was not detected by analysis of gas chromatography (minimum limit of detection: 0.01%), but the main ingredients of exhaust gas were CO<sub>2</sub>, N<sub>2</sub> or SO<sub>2</sub>, NO<sub>2</sub>, etc.

[0052]

[Table 3]

試験例	ハロゲン化ビス処理剤	ハロゲン化ガス種	ハロゲン化ガス導入量 (ml/min)	窒素導入量 (ml/min)	反応温度 (°C)	ハロゲン化ガス分解効率 (%)
1	実施例1	CF <sub>4</sub>	50	450	800	>99.9
2	実施例2	CF <sub>4</sub>	50	450	800	>99.9
3	実施例1	C <sub>2</sub> F <sub>6</sub>	50	450	600	>99.9
4	実施例1	C <sub>3</sub> F <sub>8</sub>	50	450	600	>99.9
5	実施例1	CHF <sub>3</sub>	50	450	300	>99.9
6	実施例1	CCl <sub>2</sub> F <sub>2</sub>	50	450	600	>99.9
7	実施例1	CHClF <sub>2</sub>	50	450	500	>99.9
8	実施例1	SF <sub>6</sub>	50	450	500	>99.9
9	実施例1	NF <sub>3</sub>	50	450	300	>99.9
10	実施例3	CF <sub>4</sub>	50	450	800	>99.9
11	実施例4	CF <sub>4</sub>	50	450	800	>99.9
12	実施例5	CF <sub>4</sub>	50	450	800	>99.9

[0053]The example 13 of an examination, and 14 following With the halogenated gas processing agent, the halogenated gas kind, the halogenated gas introduction amount, the nitrogen introduction amount, and reaction temperature which are shown in [Table 4], the above-mentioned basic operation was carried out, respectively, gas chromatography analyzed the emission gas extracted from the sampling port, and the

cracking severity of halogenated gas was searched for. It is the following about the result. It was shown in [Table 4]. Following The halogenated compound was not detected by analysis of gas chromatography by the exhaust gas processed by the halogenated gas processing agent of this invention (minimum limit of detection: 0.01%), but the main ingredients of exhaust gas were CO<sub>2</sub>, N<sub>2</sub>, etc. so that clearly from the result shown in [Table 4].

[0054]

[Table 4]

試験例	ハロゲン化ガス処理剤	ハロゲン化ガス種	ハロゲン化ガス導入量 (ml/min)	窒素導入量 (ml/min)	反応温度 (°C)	ハロゲン化ガス分解効率 (%)
13 実施例1		CF <sub>4</sub> C <sub>2</sub> F <sub>6</sub> C <sub>3</sub> F <sub>8</sub> CHF <sub>3</sub>	100 100 100 100	100	800	>99.9
14 実施例8		CF <sub>4</sub> C <sub>2</sub> F <sub>6</sub> C <sub>3</sub> F <sub>8</sub> CHF <sub>3</sub>	100 100 100 100	100	800	>99.9

[0055]The example 1 of a comparative study – 5 following With the halogenated gas processing agent, the halogenated gas kind, the halogenated gas introduction amount, the nitrogen introduction amount, and reaction temperature which are shown in [Table 5], the above-mentioned basic operation was carried out, respectively, gas chromatography analyzed the emission gas extracted from the sampling port, and the cracking severity of halogenated gas was searched for. It is the following about the result. It was shown in [Table 5]. Following CF<sub>4</sub>, which is not decomposed into the exhaust gas processed by the halogenated gas processing agent obtained by the above-mentioned comparative examples 1–5 was detected by analysis of gas chromatography so that clearly from the result shown in [Table 5].

[0056]

[Table 5]

比較試験例	ハロゲン化ガス処理剤	ハロゲン化ガス種	ハロゲン化ガス導入量 (ml/min)	窒素導入量 (ml/min)	反応温度 (°C)	ハロゲン化ガス分解効率 (%)
1 比較例1	CF <sub>4</sub>	CF <sub>4</sub>	50	450	800	7.0
2 比較例2	CF <sub>4</sub>	CF <sub>4</sub>	50	450	800	77.0
3 比較例3	CF <sub>4</sub>	CF <sub>4</sub>	50	450	800	67.0
4 比較例4	CF <sub>4</sub>	CF <sub>4</sub>	50	450	800	58.5
5 比較例5	CF <sub>4</sub>	CF <sub>4</sub>	50	450	800	98.6

[0057]The examples 15–17 of an examination, and the example of comparative study 6 following With the halogenated gas processing agent, the halogenated gas kind, the halogenated gas introduction amount, the nitrogen introduction amount, and reaction temperature which are shown in [Table 6], the above-mentioned basic operation was carried out, respectively, gas chromatography analyzed the emission gas extracted from the sampling port, and the cracking severity of halogenated gas was searched for. It is the following about the result. It was shown in [Table 6]. Following The halogenated compound was not detected by analysis of gas chromatography by the exhaust gas processed by the halogenated gas processing agent of this invention (minimum limit of detection: 0.01%), but the main ingredients of exhaust gas were CO<sub>2</sub>, N<sub>2</sub>, etc. so that clearly from the result shown in [Table 6]. On the other hand, CF<sub>4</sub> which is not decomposed into the exhaust gas processed by the halogenated gas processing agent obtained by the above-mentioned comparative example 6 was detected by analysis of gas chromatography.

[0058]

[Table 6]

試験例	ハロゲン化ガス処理剤	ハロゲン化ガス種	ハロゲン化ガス導入量 (ml/min)	窒素導入量 (ml/min)	反応温度 (°C)	ハロゲン化ガス分解効率 (%)
15 実施例6	CF <sub>4</sub>	CF <sub>4</sub>	50	450	800	>99.9
16 実施例6	CF <sub>4</sub>	CF <sub>4</sub>	50	450	800	>99.9
17 実施例7	CF <sub>4</sub>	CF <sub>4</sub>	50	450	800	>99.9
比較試験例6	比較例6	CF <sub>4</sub>	50	450	800	58.1

[0059]The example 18 of an examination – 28 following With the halogenated gas processing agent, the halogenated gas kind, the halogenated gas introduction amount, the nitrogen introduction amount, and

reaction temperature which are shown in [Table 7], the above-mentioned basic operation was carried out, respectively, gas chromatography analyzed the emission gas extracted from the sampling port, and the cracking severity of halogenated gas was searched for. It is the following about the result. It was shown in [Table 7]. Following To the exhaust gas processed by the halogenated gas processing agent of this invention, so that clearly from the result shown in [Table 7]. The halogenated compound was not detected by analysis of gas chromatography (minimum limit of detection: 0.01%), but the main ingredients of exhaust gas were CO<sub>2</sub> and N<sub>2</sub> or SO<sub>2</sub>, NO<sub>2</sub>, etc.

[0060]

[Table 7]

試験例	ハログン化処理剤	ハログン化ガス種	ハログン化ガス導入量 (ml/min)	空素導入量 (ml/min)	反応温度 (°C)	ハログン化ガス分解效率 (%)
18	実施例8	CF <sub>4</sub>	50	450	800	>99.9
19	実施例8	C <sub>2</sub> F <sub>6</sub>	50	450	600	>99.9
20	実施例8	C <sub>2</sub> F <sub>1</sub>	50	450	600	>99.9
21	実施例8	CHF <sub>3</sub>	50	450	300	>99.9
22	実施例8	CCl <sub>2</sub> F <sub>2</sub>	50	450	600	>99.9
23	実施例8	CHClF <sub>2</sub>	50	450	500	>99.9
24	実施例8	SF <sub>6</sub>	50	450	500	>99.9
25	実施例8	NF <sub>3</sub>	50	450	300	>99.9
26	実施例9	CF <sub>4</sub>	50	450	800	>99.9
27	実施例10	SF <sub>6</sub>	50	450	500	>99.9
28	実施例11	SF <sub>6</sub>	50	450	500	>99.9

[0061]

[Effect of the Invention] Moreover, the halogenated gas processing agent of this invention can disassemble efficiently comparatively the compound containing halogen, such as PFCs, HFCs, HCFCs, and CFCs, at low temperature. And by also being able to detoxicate the toxic substance which is the decomposition product, and combining with an eliminating unit, it can operate over a long period of time, and can process continuously [ there is nothing and ] with regards to the concentration of the halogenated compound in gas.

[Translation done.]